Embedded Linux
Birds of a Feather Session

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State of Embedded Linux

- For each technology area:
  - Areas of ongoing interest
  - Interesting kernel patches
  - Recent news
Tech areas:

- Security
- RealTime
- Bootup Time
- Size
- Power Management
- Multimedia
Security

• SELinux vs. AppArmour vs. Tomoyo
  – Big fights on kernel mailing list about pathname-based vs. label-based security.
  – Will a pathname-based security system ever make it into the kernel?

• Crispin Cowan (and other AppArmour developers) were layed off from Novell

Security (cont.)

- Smack just got mainlined
  - SELinux devs got a Linus "smack-down"
Real time - mainline status

- RT-preempt is continuing its march to mainline
- Was following Thomas' timeline until 2.6.21:
  - July 2006: (2.6.18) pifutexes, generic interrupt layer (ARM, PPC), lock dependency validator
  - October 2006: (2.6.19) generic interrupt layer (i386, x86_64, MSI)
  - February 2007: (2.6.21) high res timer / dynticks core code + i386 support
- What's left to mainline
  - threaded interrupt handlers
  - sleeping spinlocks core
  - real time core code (i386, x64_86)
  - .... more architecture support
Tracing

• Kernel Function Trace
  – New maintainer = Nicholas McGuire
  – Really useful to find kernel bootup latency problems

• Markers
  – mainlined in 2.6.24

• Embedded Bootchart
  – Fujitsu, Motorola worked on this
Bootup time

- Fast resume boot techniques are in production
  - e.g. Sony DSC-G1 camera uses snapshot boot
- Faster dynamic linking
  - MIPS prelinking project
  - GNU Hash
- File system mount time
  - Logfs
    - Funding by CELF
  - See Jamboree17 page
Bootup Time

• RC script replacement

• Application time-wasters
  – Dave Jones excellent talk from OLS 2006
    • See Dave Jones blog for June 13 for details
    • Dave says “Looks like there's still mileage in that talk after all.”
Size

• Application size is now a bigger problem than kernel size!

• Compressed file systems are important
  – Squashfs not getting mainlined
  – LogFS funding

• Application XIP
  – CramFS XIP patches still not mainlined
Kernel Allocator

- SLUB vs. SLAB vs. SLOB
- In 2.6.23 both SLUB and SLOB received some updates. Nick Piggins wants to know what the size difference is between SLOB and SLUB.
- SLUB is on a track to replace SLAB
- Christoph Lameter tried to remove SLOB, but was rejected
  - We need to show value of SLOB. If you have test results, please send them to LKML
  - My results: 150K difference in free memory available after boot
Linux-tiny

- Some big reduction patches already integrated (about 2.6.11)
- New maintainer: Michael Opdenacker
- Patches for 2.6.23 available now
- Some patches to be mainlined soon
Kpagemap

- System-wide memory instrumentation
- Allows for detailed look at system memory utilization
- Queued in mm
- Matt Mackall still working on resolving some issues
Size (cont.)

• uClibc
  – Good size, but not well-maintained
  – Could be a refuge from LGPL v3

• LSB profile for embedded
  – Discussed at Collaboration summit
Power Management

- Still lots of problems
  - Frameworks have been difficult to mainline
- Lesswatts.org
- New utility: powertop
  - Shows problem timers
  - Shows ACPI state info
    - Would be nice to get something similar working for embedded platforms
Multimedia

- Linux Sound currently a mess
  - Too many competing, incompatible sound systems:
    - JACK, ALSA, OSS, ESD
    - CELF recommends to use and support ALSA
  - See presentation by Lennart Poettering from OLS:
- Gstreamer gaining traction in handheld space
License

- Kernel safe for now, what about libs??

The 2.6 and 2.6.1 releases of the GNU C Library are licensed under the LGPL version 2.1, and GPL version 2.1 for the non-library programs included, or any later version. This means you are free to redistribute this version under the terms of the LGPL version 3 or the GPL 3, as well under as the version 2.1 terms of the 2.6 release. We expect that the next non-bug-fix release of the C Library will migrate to a newer LGPL version
Distributions

- OpenEmbedded
  - Still moving along, CELF has funded some work

- Embedded Debian
  - Don’t know status

- Fedora for ARM
  - New project
Interesting Products

• Sony PS3

• Sony HD Camcorders and Digital Still Cameras
  – 2 second cold boot to application active
  – DSC-G1 = a sweet product (if I say so myself)
    • Wireless, with DLNA

• Motorola phones
  – Linux phone coming to US by end of 2007
New Organizations

- OSDL + FSG = The Linux Foundation
- LiMo = Linux in Mobile organization
- GMAE = Gnome Mobile and Embedded
Projects

- OpenMoko
- Ubuntu mobile
- Maemo
- Mobilinux
- ARM Initiative = GNOME customizations for ARM??
Embedded Wiki

- CELF is building an Embedded Linux wiki
  - http://elinux.org/
Open Discussion